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[SIXTH SERIES.]

“..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchyliis succo.”
N. Parthenii Giannettasii Eol. 1.

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I.—*A new Species of Munna from New Zealand.*
By CHARLES CHILTON, M.A., B.Sc.

[Plates I. & II.]

THE genus *Munna* was established in 1839 by Krøyer; but as yet only a comparatively small number of species appear to be known. Beddard, writing in 1886, says that only five species were then known, all of them being inhabitants of the shallow water off the coasts of Great Britain, Norway, North America, &c.* He adds two species, *M. maculata* and *M. pallida*, both obtained from shallow water off Kerguelen Land during the ‘Challenger’ Expedition. Each of his species is remarkable for some point: *M. pallida* has the eyes without the appreciable stalks found in other species, and in *M. maculata* the male has the same form of body as the female and is not narrowed and elongated as in some of the other species of the genus.

I am now able to add another species, found between tide-marks on the coasts of New Zealand. As in *M. maculata*, the male has the same form of body as the female; the species appears to differ from the others hitherto described in having the first pair of thoracic appendages of the male very large

* Report of the ‘Challenger’ Isopoda, part ii. p. 24.
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and of a peculiar shape. As I have an abundance of specimens, I am able to describe the species in greater detail than has been done for some of the others, and also to give pretty fully the peculiar characters of each sex.

Most of my specimens are from Port Chalmers in Otago Harbour. They were taken during low tide on the surface of stones and boulders under a mass of decaying *Boltenias* that had been washed up on the beach. They were found in great numbers and of all sizes, many of the females bearing eggs or young. I have not taken them in the same locality either before or since, although I have several times hunted over the same spot. Possibly some of them had been washed up with the *Boltenias* and had afterwards increased on the beach, though, if so, they must have increased very rapidly, as the *Boltenias* had evidently not been there for more than a few days. The specimens of the *Munna* were so numerous on all the stones near that it scarcely seems possible that they could all have been washed up with the *Boltenias*. They walked about on the stones somewhat slowly but with perfect ease, and seemed quite at home out of the water. The excessively long hind legs and the very long antennæ, which they carried bent back over the body, gave them a very spider-like appearance.

I have since taken a single specimen on sea-weed in a rock-pool in Port Chalmers, and another from a rock-pool at Brighton, on the east coast of Otago.

The new species now to be described agrees closely with the characters of the genus as they are given by the various authors. According to Beddard the affinities of *Munna* are with *Pleurogonium* and its immediate allies, though it also approaches *Jura*, *Janira*, &c. in having biunguiculate thoracic appendages*. This affinity with the latter genera is fully confirmed by an examination of the mouth-parts and pleopoda of the present species, as a comparison of them with those of *Ianthe speciosa* as described by Bovallius† shows that they closely conform to the Asellidan type. Bovallius, however, does not include *Munna* in his "Notes on the Family Asellidæ" ‡.

I shall first give a short specific diagnosis of the species, and afterwards describe some of its parts in greater detail.

Munna neozelanica, sp. n. (Plates I. & II. figs. 1-15.)

Male.—Body narrow-elliptical, length about two and a half

* Report on the 'Challenger' Isopoda, part ii. p. 24.

† Bihang till K. Svenska Vet.-Akad. Handlingar, Band 6, no. 4.

‡ L. c. Band 11, no. 15.

times the greatest breadth. Head not broader than the first segment of pereion, deeply notched on each side for the bases of the antennæ, produced anteriorly between the antennæ; front margin straight, with rounded upper lip attached. The lateral portion behind the insertion of the antennæ with the anterior angle somewhat acute, the posterior angle rounded, somewhat produced, and bearing the moderately-sized eyes. First four segments of the pereion subequal in length, gradually increasing in width up to the fourth, which is the widest; next three segments subequal and slightly shorter than the preceding, curving slightly backwards at the sides. All the segments having the lateral margins straight or slightly rounded. Pleon as long as the four preceding segments of the thorax, pear-shaped, narrowing posteriorly, extremity rounded.

Antennules with the first two joints stout, others slender, reaching a little beyond the end of the third joint of the antennæ. Antennæ considerably longer than the body. First pair of legs very large and strong and of peculiar shape, the ischios being very thick and strong and hollowed anteriorly to receive the distal part of the limb when bent back; carpus expanding distally, mallet-shaped at the end; propodos small and rounded. Succeeding legs of usual shape, the last three pairs longer than the others, about as long as the body.

Female with the body of the same shape as in the male; differs from the male in the first pair of appendages of the pereion, which are short and imperfectly subchelate; carpus broader than the propodos, having the inner edge armed with six strong spiniform setæ.

Colour brownish, more or less closely covered with darker dots and stellate markings.

Length of body of largest specimens about 3 millim.

Hab. Port Chalmers and Brighton, New Zealand, between tide-marks.

Remarks.—In the shape of the body and in the fact that the male and the female have the body of the same form, this species appears to resemble *M. maculata*, Beddard, but the form of the first pair of legs is evidently very different; it also differs in the antennules and in other points. It seems to be quite different from *M. pallida*, Beddard.

Detailed Description.

The *head* (Pl. I. figs. 1 and 3) is broad, about twice as broad as long, and longer than the two succeeding segments

of the pereion; on each side it is deeply notched for the insertion of the antennæ; it is produced in front between the antennæ and has the front margin, to which the upper lip is attached, straight, with the lateral angles well rounded. The lateral portion behind the bases of the antennæ has the anterior angle somewhat acute and the posterior angle produced and rounded and bearing the large eyes, which are thus somewhat pedunculated, though apparently not so much so as in some other species of the genus.

The *pereion* (Plate I. fig. 1) has the first segment a little broader than the head, rather shorter than the second, the second, third, and fourth subequal in length, widening slightly up to the fourth segment, which is the widest; the fifth, sixth, and seventh segments are progressively shorter and curve backwards at the sides into rounded lobes, which are somewhat gaping laterally.

The *pleon* (Plate I. fig. 1) is much narrower than the pereion, somewhat conical or pear-shaped, rapidly narrowing posteriorly, with the extremity rounded. It usually projects slightly upwards, and the uropoda are barely visible in a dorsal view.

The *antennules* (inner antennæ) (Plate I. figs. 2 and 3) reach somewhat beyond the end of the third joint of the peduncle of the outer antennæ. The first or basal joint is the broadest, being about two thirds as broad as long; the second joint is about as long as the first, but only half as broad at the base; it expands considerably towards the distal end and bears a few fine setæ scattered over the surface; the next two joints are subequal, small, the two together being less than half the length of the second joint; each is nearly as broad as long, they are followed by a long slender joint as long as the second and third together; at the extremity of this are two very small joints provided with long "olfactory filaments."

In the possession of the long slender joint at the end of the antennules this species resembles *Munna Whiteana*, Spence Bate and Westwood*. It is evidently, however, subject to some variation, for I have one specimen in which the right antennule is of the normal shape, as already described, but the left one has the long fifth joint only about two thirds as long as that on the right, while the following joint is much larger than usual, being about one half the length of the fifth joint; both of these bear "olfactory filaments," so that doubtless the long fifth joint should be looked upon as a modified portion of the flagellum.

* 'British Sessile-eyed Crustacea,' ii. p. 329.

The *antennæ* (Plate I. figs. 1 and 3) are very long, when fully developed being considerably longer than the body; in small specimens they are shorter in proportion to the body. They present nothing remarkable in their character. The first three joints are subequal, short, the fourth and fifth subequal, very long, slender; the flagellum slender, about as long as the whole peduncle. The antennæ are often bent sharply backwards at the end of the third joint, so that the fourth joint is directed backwards, while the fifth and the flagellum are directed forwards again. There is no trace of the rudimentary exopodite found in *Janira*, *Ianthe*, and *Stenetrium*.

The *upper lip* (Plate I. figs. 4 *a* and 4 *b*) is attached to the front margin of the head and is directed forwards and partly downwards. It is nearly semicircular, slightly convex above; in the centre the front margin curves over underneath, so that when viewed from above the lip appears slightly emarginate in the centre. When viewed from below it is seen that the middle portion of the front bears many short setæ, those on each side being directed inwards.

The *mandibles* (Plate I. figs. 5 *a* and 5 *b*) are similar to those of *Ianthe*. The right mandible has only one cutting-edge, ending in four distinct sharp teeth, next to which come five large pectinated setæ, arranged in an oblique line across the end of the mandible. The seta nearest the end is the broadest and the most pectinated, being quite comb-shaped; the others are longer, but gradually decrease in breadth and in the number and size of the pectinations, the fifth having only a few pectinations towards the end. The molar tubercle is long, rather slender, and has the end obliquely truncate and bearing two or three rather long setæ in addition to the usual short thick-set setæ which form the grinding-organ at the end.

The left mandible is similar, but has two cutting-edges, the end one with five teeth and the inner with four; then follow four or five pectinated setæ, as in the right.

The *palp* (fig. 5 *b*), which is the same on each side, consists of three joints, the second being the longest and about half as long again as the first; towards its distal end it bears two stout serrated setæ; the third joint is somewhat shorter than the first and bears five or six stout setæ on one side towards the distal end; these are placed at right angles to the joint and are curved and serrated on the concave edge; they increase regularly in length distally, the last one being nearly as long as the joint itself. The third joint is usually bent at right angles to the second.

The *lower lip* (Plate I. fig. 6) consists of two portions almost completely separated; I have never been able to dissect out the two parts together. Each is subtriangular in outline, the inner margin nearly straight, the outer strongly curved and somewhat sinuous, the distal extremity being acute. The distal half of the inner margin is fringed with short setæ which gradually increase in length distally, the longest being placed at the extremity; the outer margin is free from setæ.

The *first maxilla* is of the usual shape and consists of two lobes, the outer longer than the inner, slender, narrowing towards the extremity, and bearing at the end about ten broad comb-like setæ; the inner lobe is only about half as long as the outer, broadest at the base, bearing at its extremity four or five long curved setæ, plumose towards the end, and also two or three finer simple setæ.

The *second maxilla* is also of the usual shape, consisting of a broad basal portion bearing three subequal plates, the inner forming a prolongation of the base, the outer two being articulated to it. The two outer plates are similar and subequal, oblong, each bearing at the end four long setæ, the three outer very finely pectinated on the inner margin, the inner one shorter than the others and coarsely pectinated, the pectinations being at right angles to the seta. The inner plate bears at its extremity eight to ten setæ of various sizes, some stout and pectinated, others fine; there are also some fine slender setæ or hairs on the inner margin.

The *maxillipedes* (Plate I. fig. 7) are well developed and broad and appear to form a sort of operculum to protect the mouth-parts. The basal joint (*coxos*) is short, transverse, and bears the elliptical *epipodite* and the large *basos*. The margin of the epipodite is quite free from setæ and quite entire except for a short distance towards the end on the outer side, where it is finely crenate. The *basos* is very large and forms much the largest part of the whole appendage; its inner margin is straight and it is produced distally into a flat plate nearly as large as the *basos* proper; the extremity of this plate bears numerous short pectinated setæ. On the inner margin are four stout setæ, slightly hooked or enlarged at the end so as to fit into those on the other side and hold the two halves of the maxillipedes together. The "palp" (*endopodite*) has the *ischios* short transverse, the *meros* is much larger and expands distally, and has both margins, but especially the inner one, fringed with long setæ; the *carpus* is much broader than long, the inner margin rounded and

densely covered with setæ, a few being placed also at the outer distal angle; the *propodos* is narrow and about as long as the carpus is broad; it expands slightly distally, curves inwards, and bears long setæ on both margins; the *dactylos* is less than half as long as the propodos, and ends in two long stout setæ.

The *legs of the first pair* (Plates I. and II. figs. 8 *a*, 8 *b*, 8 *c*, 8 *d*) are very different in shape in the two sexes. It will be convenient to describe those of the female first, as they are the more normal in shape. The *basos* (see fig. 8 *a*) is subrectangular and about twice as long as broad, the *ischios* is about as long as the basos but slightly narrower, the *meros* is triangular, expanding distally, the antero-distal angle slightly produced and bearing a single stout seta, a few setæ being also present on the posterior margin; the *carpus* is also triangular, but is larger and broader and has the postero-distal angle produced, the distal end of the joint being straight but oblique; there are a few fine setæ on the anterior margin and the posterior margin is supplied with about six stout spini-form setæ and a few fine scattered hairs; the *propodos* is considerably narrower than the carpus, but of about the same length, the anterior margin is convex and bears several fine setæ, there are usually a few also on the posterior margin and at the end, the largest being situated at the rounded postero-distal angle; the *dactylos* with the claws is as long as the posterior margin of the propodos, it bears a few fine setæ, and ends in two distinct claws, the outer one fully twice as large as the inner.

From the figure and description given it would appear that the first pair of legs in the female in this species is not very dissimilar from that of *Munna Kröyeri*, Goodsir, as drawn and described by Bate and Westwood, though they state that only the male of that species is known, and their figure would therefore presumably apply to the male.

In the *male* the first pair of legs are very large and peculiar in shape. The first joint (fig. 8 *d*), which might at first sight be taken for the *coxos* (epimeron), but is really the *basos*, is very short and small, and from it arises a very large *ischios*. This joint is large and subrectangular, not quite twice as long as broad, and the whole joint is filled with a very powerful muscle, which moves the next joint and with it the remainder of the limb. In front the *ischios* is deeply grooved and receives the distal portion of the limb when bent back; at the base it is the inner portion of the *ischios* that is produced forwards, while at the distal end the outer portion

is produced forwards and downwards to form the groove, so that when the end of the limb is bent back upon the ischios it is protected and held in its place both on the inside and the outside. The *meros* is flat or hollow above and expands a little distally, its articulation with the ischios is concealed in a view from the outer side by the prolongation of the outer portion of the ischios. The *carpus* is nearly as wide at the base as the preceding joint, but expands distally and has the end shaped something like a mallet, being produced both above and below, the lower portion finely crenate—the exact form will be learnt from the figure more easily than from any verbal description. The *propodos* is attached to the upper distal corner of the carpus; it is nearly circular in shape, and bears a small dactylos which ends in two claws as in the other legs. The whole limb is, in fully developed males, quite free from setæ; the ischios and meros are rather thick through from side to side, but the carpus and propodos are thinner and plate-like.

The whole leg is most striking in appearance and quite unlike anything else that I have seen among the Isopoda. It most probably forms a grasping-organ of some kind, though it is not easy to see exactly how it is used, and while grasping-organs are usually formed by means of the terminal joints (*propodos* and *dactylos*) in other species, in this case these are small and more or less rudimentary.

In young males the first pair of limbs is much more like those of the female and quite different from those of the fully developed male. One stage in the development is shown in figure 8 *b* of Plate II. The basos is of fair size, though not so long in proportion to the other joints as in the female; the ischios is much larger and already shows signs of its future great expansion; the remainder of the limb is practically the same as in the female, except that there are fewer spini-form setæ on the carpus. A more advanced stage is shown in figure 8 *c* of Plate II. The ischios is more enlarged, the meros more elongated and more like that of the adult male, the carpus has begun to take its peculiar mallet shape, the propodos is becoming more rounded, and the setæ have almost disappeared from the whole limb.

It will thus be seen that in this species, as in many other cases, the young male resembles the female, and that the peculiar characters of the adult male are acquired by a gradual development*.

* See Darwin's 'Descent of Man,' p. 232 (second edition).

The *legs of the second pair* (Plate II. fig. 9) are about two thirds the length of the body and are normal in shape. The *coxae* (epimeron) is short, transverse, and clearly separated off from its segment; the *basos* is narrow oblong, slightly constricted proximally, margins free from setæ; the *ischios* is similar in shape but not quite so long; the *meros* is shorter than the *ischios*, narrow at the base, and has the antero-distal angle somewhat produced and bearing a seta; there are also two or three fine setæ on the posterior margin towards the distal end; the *carpus* is slightly longer than the *ischios* and *meros* together and is rather more than four times as long as broad, it bears one or two rather stout setæ on each margin towards the distal end; the *propodos* is considerably longer than the *carpus*, but is much narrower, being not quite half the width; on the posterior margin towards the distal end is a row of about twelve short stout setæ, and on the anterior margin a fringe of finer hairs, those at the base of the *dactylos* being the longest; the *dactylos* is of the usual shape and bears two distinct claws.

The *third and fourth pairs of legs* are quite similar to the second, and are of about the same size.

The *legs of the fifth pair* (see Plate II. fig. 10) are similar in general form to the preceding, but are considerably longer. The *basos* and *ischios* are subequal in length and longer than the *meros*, which, however, is more elongated than in the preceding legs; all three joints have the upper (anterior) margin fringed with a number of fine hairs; the *carpus* is rather broad and is as long as the *ischios* and *meros* together, and in addition to a few stiff setæ at the distal end has, *in the male*, the whole upper surface of the joint densely covered with long, irregular, woolly hairs, which are usually clogged with dirt, diatoms, and other extraneous matter; the *propodos* is very long and slender, being longer than the *meros* and *carpus* together; the whole upper surface is fringed with irregular fine hairs and the lower margin bears a number of stiff setæ; but these are smaller and do not form such a distinct row as those described on the second pair of legs; the *dactylos* is like that of the second pair of legs, but more elongated.

In the female the fifth pair of legs is similar to those in the male, but the *carpus* does not bear the irregular woolly hairs, and consequently the stiff setæ present are more distinctly seen.

The *sixth and seventh pairs of legs* are quite similar to the fifth and of about the same size.

The appendages of the pleon are of small size in accordance with the size of the pleon itself, and they are rather difficult to dissect out satisfactorily; but, so far as I have made them out, they present a fairly close general resemblance to those of *Ianthe speciosa* as described by Bovallius.

In the male the first pair of appendages (Plate II. figs. 11 *b* and 11 *c*) are modified to form an accessory male organ. They consist of two more or less oblong plates fitting closely against one another along the median line; they are widest at the base, where the outer margins are strongly convex; towards the middle they narrow considerably, widening again slightly towards the distal end; the extremity of each part is curved and bordered with about eight short setæ. On the underside the surface of the plates is quite flat and the lateral margins are entire (fig. 11 *b*). On the upper surface near the middle there is on each side a thin plate projecting upwards, so that a kind of groove is formed between them, the top of it being no doubt closed by the next pair of pleopoda fitting on to it above. Towards the end the surface is raised on each side into two ridges which converge towards each other as they reach the outer distal angle, thus forming a duct on each side, which reaches from nearly the centre of the joint to the outer angles (fig. 11 *c*). The whole apparatus probably serves to pass on the spermatozoa from the genital openings in the seventh segment of the pereion to the "penial filament" of the second pair of pleopoda. On the under surface the two halves of the organ are separated along their whole length, but on the upper surface they are joined together from the base until the beginning of the ducts, only the distal portions therefore being completely separated.

The second pleopoda (Plate II. fig. 12) have the main portion subtriangular, the inner edge nearly straight, outer edge curved and bearing a few short setæ towards the subacute extremity. This portion, which both Bovallius and Beddard consider the "protopodite," contains a very powerful muscle, which reaches to the "penial filament" and no doubt acts as an extensor muscle for it. This filament appears to consist of two joints, one directed backwards towards the base of the appendage and the other when at rest lying alongside it, directed in the opposite direction, slightly curved, and ending in a long, very acute extremity, apparently grooved on the concave side. Beddard considers this "penial filament" to be the "endopodite," a small soft appendage which arises from near its base he considers as the "exopodite."

The third pleopoda (Pl. II. fig. 13) consist of a basal por-

tion, the *protopodite*, which bears an inner, flat, rectangular, branchial plate, the *endopodite*, which narrows slightly towards the distal end and bears at its extremity three long, delicately plumose setæ; the outer part of the appendage, the *exopodite*, is not separated at the base from the protopodite; it consists of two joints, the first rectangular, bulging a little distally on the inner side, the second subtriangular, bearing a few small setæ at the extremity and three longer ones on the outer margin; the outer margin of both joints is also closely fringed with very fine short setæ.

The *fourth and fifth pleopoda* I have not been able to separate out quite satisfactorily, but they appear to consist of rounded branchial plates with margins quite free from setæ. Among the other parts I found the appendage represented in figure 14 of Plate II. This I believe to be the exopodite of the fourth pair of pleopoda; it is somewhat similar to the exopodite of the third pair, but narrower and more delicate; the basal portion is long and curves slightly outwards, the whole of its outer margin is finely crenated and fringed with very delicate setæ, which project radially outwards at each crenation; the second joint is subtriangular, joined to the first by an oblique articulation; it has the outer margin fringed with fine setæ and bears at the end two very long, delicately plumose setæ longer than the joint itself.

In the *female* the first pair of pleopoda (fig. 11 *a*) have been modified to form an oval operculum, which is only slightly longer than the greatest breadth; it consists of a single piece without any suture or other mark showing the different parts of which it is composed; the extremity, which is nearly straight, bears six or seven very small fine setæ.

The other pleopoda of the female, with the exception of course of the second, appear quite similar to those of the male.

The *uropoda* (Plate II. fig. 15) are very small, conical, and bear a few small setæ. They are the same in both sexes.

Sexual differences.—In no point do we find so much variety as in the characters by which the female differs from the male among the Crustacea. These differences are found sometimes in one part of the body and sometimes in another, and the parts affected are often different in closely allied species. In the present species the female differs from the male in the following points:—(1) In the character of the first pair of legs; (2) in the absence of the woolly hairs found on the carpus of the fifth, sixth, and seventh pairs of legs in the male; (3) in the special modifications of the pleopoda.

EXPLANATION OF PLATES I. & II.

[All the figures refer to *Muma neozelanica*.]

- Fig. 1.* Dorsal view (taken from a rather small female), showing some of the appendages only. $\times 19$.
- Fig. 2.* Antennule, $\times 52$.
- Fig. 3.* Lateral portion of the head, showing the eyes and the insertion of the antennules and antennæ (from a smaller specimen), $\times 52$.
- Fig. 4.* Upper lip, with front part of the head. *a*, from above, $\times 22$; *b*, from below, $\times 52$.
- Fig. 5.* Mandibles: *a*, extremity of right mandible, $\times 125$; *b*, palp of mandible, $\times 90$.
- Fig. 6.* Lower lip, $\times 52$.
- Fig. 7.* Maxillipede, $\times 52$.
- Fig. 8.* First pair of legs: *a*, of female, $\times 52$; *b*, of a young immature male, $\times 52$; *c*, of a young male, more developed, $\times 52$; *d*, of fully developed male, $\times 23$.
- Fig. 9.* Second pair of legs (of male), $\times 23$.
- Fig. 10.* Fifth pair of legs (of male), $\times 23$.
- Fig. 11.* First pleopoda: *a*, of female, forming an operculum, $\times 23$; *b*, of male, forming male organ, from below, $\times 52$; *c*, extremity of the same, from above, showing ducts &c., $\times 52$.
- Fig. 12.* Second pleopoda of male, $\times 52$.
- Fig. 13.* Third pleopoda, $\times 52$.
- Fig. 14.* Exopodite of fourth pleopoda (?), $\times 52$.
- Fig. 15.* Uropoda, $\times 90$.

II.—Note upon the Encystment of *Æolosoma*.

By FRANK E. BEDDARD, M.A., F.R.S.E.

THE observations to be recorded in the present note were made upon material kindly supplied to me by Mr. O. H. Latter, Science Master at Charterhouse. Knowing my interest in this group of Worms, Mr. Latter was so good as to forward me three tubes containing decaying plants from an aquarium, among which were a large number of specimens of one of the species of *Æolosoma* with red oil-globules in the integument. Two or three individuals were found in every sample of the water from these tubes examined with the microscope; they were of varying sizes, some being twice or even thrice the bulk of others: reproduction by gemmation was not going on with any vigour—a fact possibly due to the commencement of the cold weather; nor, on the other hand, were there any indications whatever of sexual maturity. With the cessation of the asexual method of reproduction one would perhaps expect to meet with some indication of the acquirement of sexual organs; but no such indication was observable in any of the individuals which I submitted to examination. The sexual organs of *Æolosoma Ehrenbergii*